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CMPE 230: Systems Programming, Spring 2023, Final

Problem 1 (18 pts)

Give the Linux commands that will do the following:

(a) Execute the program **`prog.exe`** and send its error messages to the null device.
(b) Execute the program called **`prog.exe`** in the background.
(c) Assign the permission mode "**`-rwxr-x--x`**" to the file **`datafile`**.
(d) Execute the program **`prog.exe`** and append its output to the file **`out.txt`** while also showing the output in the terminal.
(e) Create a static library file **`libveli.a`** using the object files in the directory **`/home/veli/PROJ`**
(f) Do remote login to a computer named **`mach1.cmpe.boun.edu.tr`** with secure shell (and using username **`veli`**).
(g) Display the manual page for gcc.
(h) List of all files including the hidden ones.
(i) Kill the process numbered 321.

Problem 2 (20 pts)

Consider the following program prog.c. It is compiled with the command:
g++ prog.c (i.e. for 64-bit system). What is the output of the program ?

```
#include <iostream>
using namespace std;

template <class T>
T funcA(T a, T b) {
  return(a-b) ;
}

class X {
  private:
    int x ;

  public:
    X(int a) {
      x = 2*a ;
      cout << x << endl ;
    }
    ~X() {
      x = 3*x ;
      cout << x << endl ;
    }
    void h(int t) {
      if (t) {
         x = funcA<int>(x,1) ;
         t = t - 1 ;
      }
    }
    int getx() {
      return(x) ;
    }
};
```

```
void funcB(X ** pobj ) {
   X  fobj(1) ;

   *pobj = new X(2) ;
   fobj = **pobj ;
   (*pobj)->h(2) ;

   *pobj = new X(3) ;

}

int main() {
  X  *pobj    ;
  X   obj(4)  ;

  funcB(&pobj) ;
  cout << obj.getx() << endl ;
  cout << sizeof(pobj) << endl ;
  obj.h(2) ;
  cout << obj.getx() << endl ;

  delete(pobj) ;
  return 0;
}
```

```
Write your answer
Here:
```

Problem 3 (20 pts)

Consider the following statement:

```
a = (2+a)*a +  a
```

a) Write down the postfix expression for the statement.

b) Write down the A86 assembly code that can be generated for the following program.

```
a = 1 ;
for (i=1 ; i <= 2 ; i++) {
   a = (2+a)*a + a ;
}
```

Problem 4 (20 pts)

The following assembly code was produced by the GNU C compiler by compiling a C program with the `gcc -S -m32` command . The C program only had a main function with some variable definitions and statements. Only a part of the generated assembly code is shown below:

Generated GNU assembly code	C Code (write your answer here)

_main:
LFB1:
pushl %ebp
LCFI0:
movl %esp, %ebp
LCFI1:
subl $16, %esp
call ___x86.get_pc_thunk.ax
L1$pb:
movl $7, -4(%ebp)
movl $4, -8(%ebp)
movl $5, -12(%ebp)
movl -4(%ebp), %eax
imull -8(%ebp), %eax
movl %eax, -4(%ebp)
movl -12(%ebp), %eax
addl %eax, -8(%ebp)
movl -4(%ebp), %eax
addl %eax, -12(%ebp)
movl -8(%ebp), %eax
subl -12(%ebp), %eax
movl %eax, -4(%ebp)
movl $0, %eax
leave
LCFI2:
ret	

Give the full C code that corresponds to the above GNU assembly code. (in other words, disassemble the GNU assembly code given above).

Problem 5 (22 pts)

Consider the FindDialog class that was developed in the classroom. Develop the same class this time by making use of the Qt Designer.